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(54) Abstract Title
Apparatus on a textile machine for separating unwanted material

(57) Apparatus for removing foreign material from textile fibre web in a textile machine such as a carding machine or cleaner comprises detector means such as cameras 20a,b for detecting the foreign material and determining its position widthwise of the web and an array of guide elements 25a-n across the width of the web which are independently operated in response to the signals from the detector means 20 so as to deflect only that widthwise portion of the web which contains the foreign material. The elements may actuated by piezoelectric means.

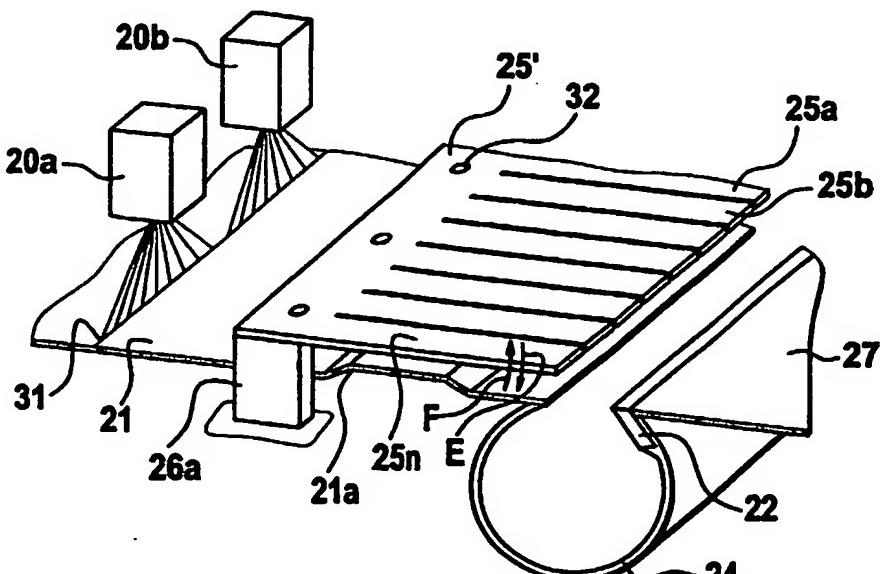
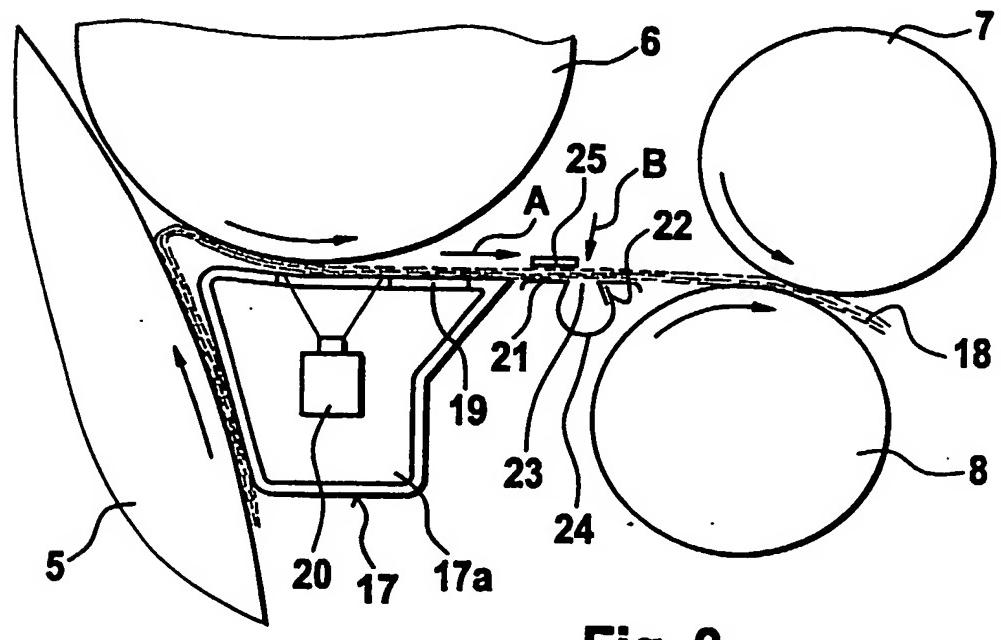
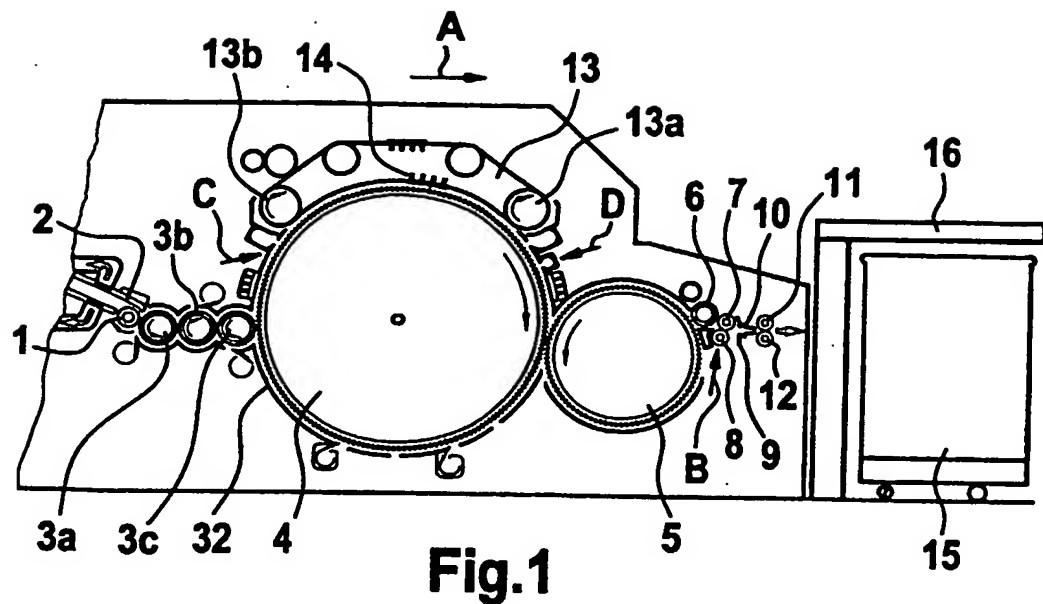


Fig.3

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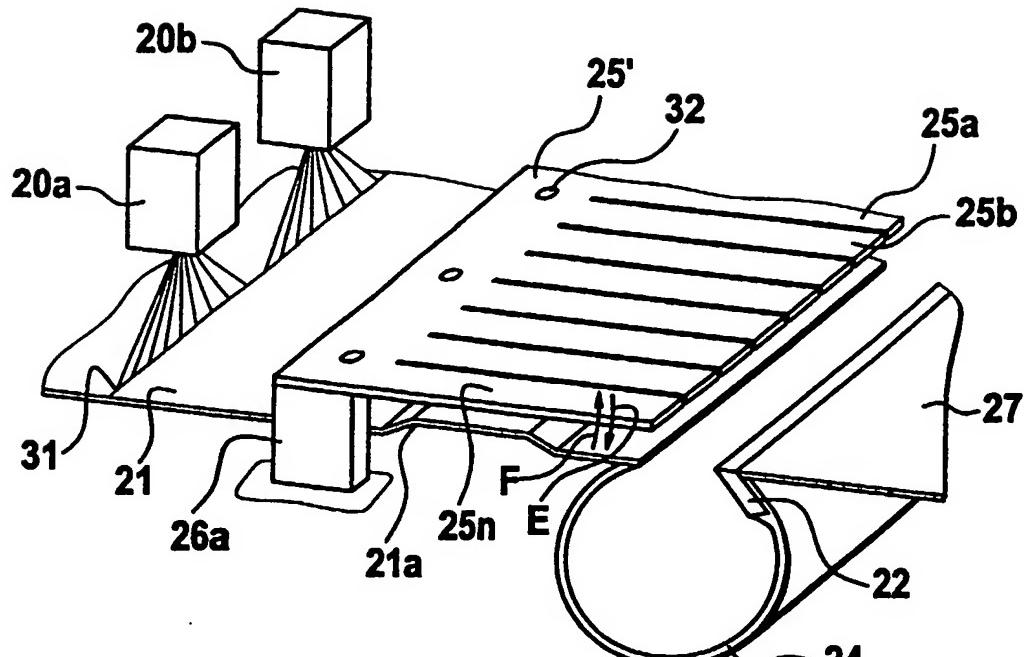


Fig. 3

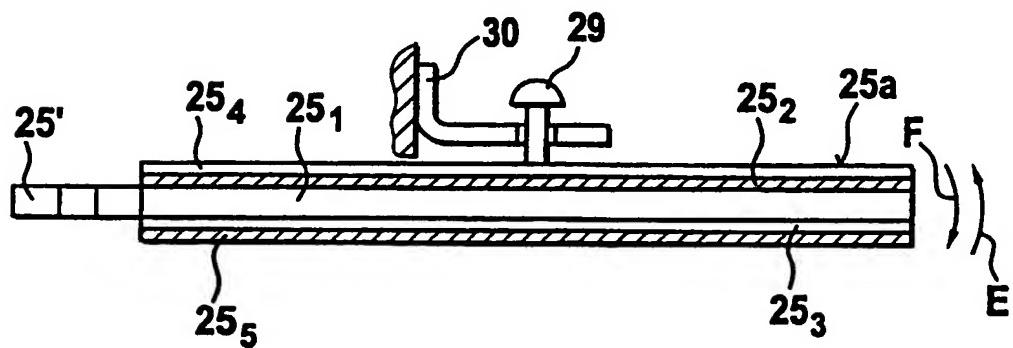
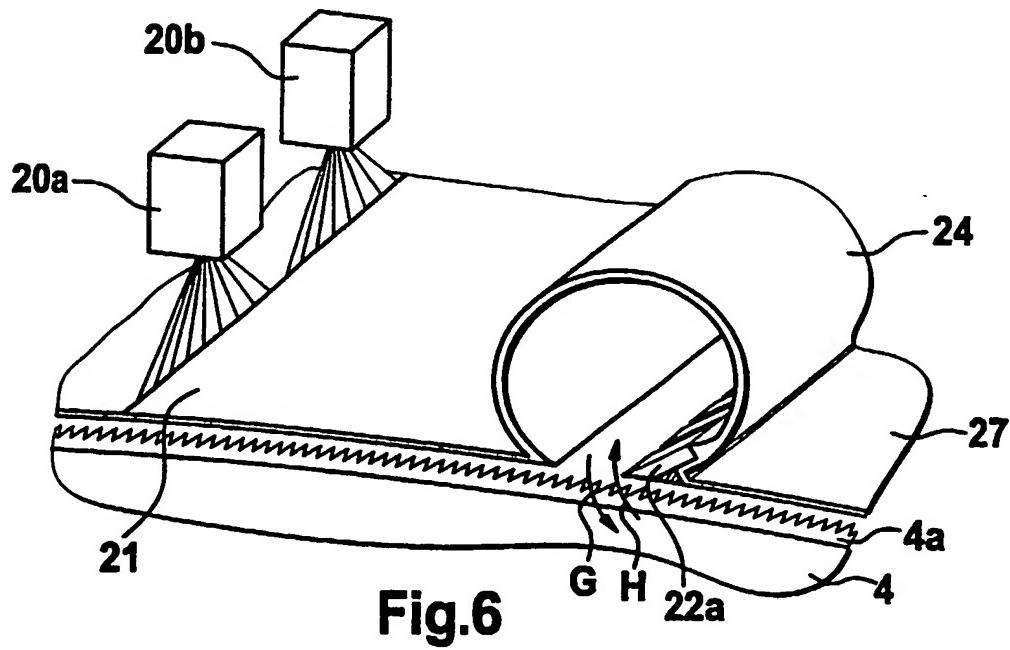
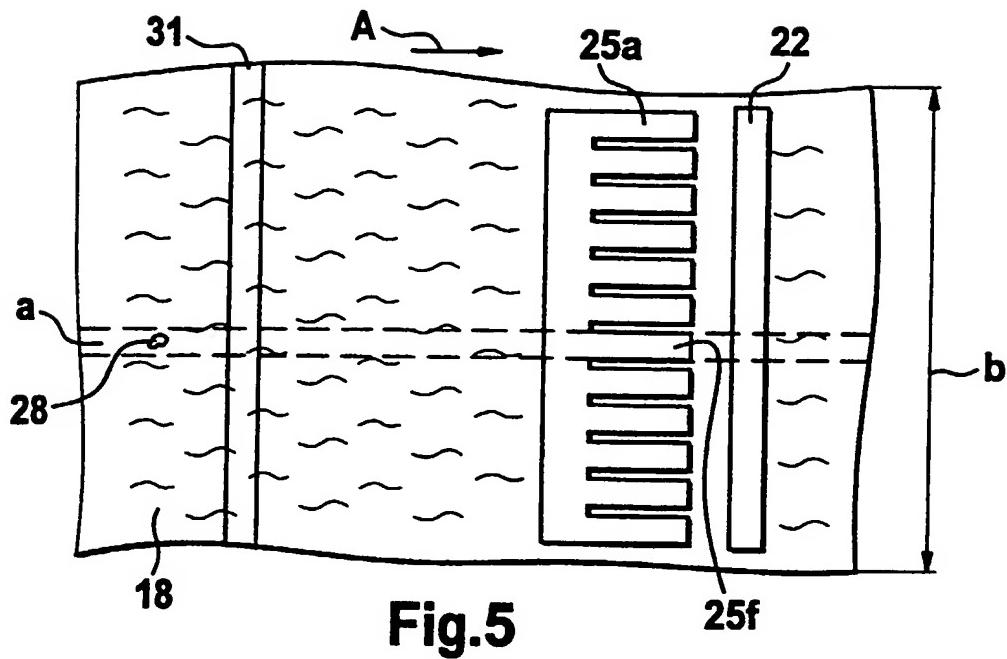


Fig. 4

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Apparatus on a textile machine for separating unwanted material

The invention relates to an apparatus on a textile
5 machine, for example a carding machine, a cleaner or the
like, for detecting unwanted particles, especially trash
particles, husk accumulations, bits of seed and the like in
textile fibre material and removing them therefrom.

In one known form of apparatus, across the width there
10 are present at least one detector device, for example, a
camera, having an electronic evaluating device for
recognition of particles, and downstream thereof a
separating device for removing the particles.

Separating blades for waste, trash or dust are used on
15 carding machines and cleaners. On cleaners, these blades
are used in conjunction with saw-tooth rollers and, in the
case of carding machines, especially at licker-ins. They
can also be associated with needle rollers. In many cases
20 the blades are used in conjunction with suction hoods or
suction pipes. There, the suction hoods have the task of
carrying off in an air current the particles of trash,
short fibres and dust that have been separated by the
blade. These blades are set to be stationary, that is, the
location of the blade, the spacing of the blade tip from
25 the roller (cylinder) and the angular position of the blade
separation edge with respect to the tangent of the cylinder
are constant throughout operation of the machines. The
drawback here is that changing the parameters of these
settings is often very difficult and can therefore be
30 carried out only when the machines are idle. The spacing
of the blade edge (tip) with respect to the saw-tooth
clothing on the licker-in can vary, for example, between

0.2 to 0.6 mm, depending on the fibre material to be processed. Adjustment of the spacing is effected manually whilst the machine is idle using a so-called spacing gauge. The blade is positioned, for example, in order to adapt to different materials, especially to different contents and types of impurity. In practice, the separating blade is in the form of a continuous, one-piece knife blade, which extends across the width of the machine. A disadvantage of the known separation blades is that adaptation to locally different contents or local concentrations or even to particular elements of foreign bodies in the fibre material, such as waste, neps, seed fragments, trash particles and so on, is not possible.

It is an aim of the invention to produce an apparatus of the kind mentioned in the introduction, which avoids or mitigates the said disadvantages, and which in particular improves the action of the separating device in a simple manner.

The invention provides an apparatus on a textile fibre processing machine or the like for detecting unwanted particles in textile fibre material and removing them therefrom, in which across the width there is provided a detector device and downstream thereof a separating device for removing the particles, wherein between the detector device and the separating device a plurality of guide elements are provided across the width, which are able selectively to deflect the regions of the fibre material containing the unwanted particles.

Because a plurality of guide elements are present, which are capable of selectively deflecting the fibre material, an individual adaptation or intensification of the separation of individual foreign bodies or local concentrations of several foreign bodies is rendered possible in a simple manner. In this way, the action of

the separating device is substantially improved, the separation being concentrated only on the individual particles and consequently being intensified. A further advantage consists in that the regions of the fibre

- 5 material with no foreign particles remain unaffected by the separating device.

The invention also provides an apparatus on a carding machine, a cleaner or the like for detecting unwanted particles, especially trash particles, husk accumulations, 10 bits of seed and the like in textile fibre material and removing them therefrom, in which across the width there are provided at least one detector device, for example a camera, having an electronic evaluating device for removing the particles, characterised in that between the detector 15 device, for example, a camera, and the separating device a plurality of guide elements are provided across the width, which are able selectively to deflect the regions of the fibre material containing the unwanted particles.

- Advantageously, the evaluating device is capable of 20 supplying control signals for at least one movable guide element. Advantageously, the movable guide elements are individually controllable. Advantageously, actuator-movable guide elements are present. Advantageously, the instant for deflection is controllable by the camera. 25 Advantageously, selection of the corresponding guide element or the corresponding guide elements is controllable by the camera. Advantageously, a controllable adjusting device is associated with each guide element. The adjusting device may comprise inductive elements. The 30 adjusting device may comprise pneumatic elements. The adjusting device may comprise piezoelectric elements. Advantageously, the guide element comprises a piezoceramic bending transducer.

Advantageously, the detector device scans the fibre material across the width for impurities and the like.

Advantageously, an optical measuring device is connected to an electronic image-processing device. Advantageously, the 5 electronic image-processing device comprises a control device, for example, a computer. Advantageously, actuators for adjusting the guide elements are present.

Advantageously, the displacement of at least one guide element selectively changes the spacing between the fibre 10 material and the separating device. Advantageously, the spacing is reduced on displacement of at least one guide element. Advantageously, the fibre material runs between the guide elements and an opposite surface.

Advantageously, the fibre material is in contact at least 15 during deflection with the guide elements.

The invention also provides an apparatus on a textile fibre processing, in which downstream of a feed device there is arranged a rotating clothed or needle roller that is surrounded by a casing with at least one opening for 20 removal of impurities, in which associated with the clothing or the needles of the clothed or needle roller is at least one separating blade comprising a blade edge that is directed against the direction of rotation of the clothed or needle roller and is arranged at the opening, 25 wherein the separating blade comprises a plurality of blade elements and the spacing between the individual blade elements and the clothing or the needles of the clothed roller or needle roller can be changed.

Furthermore, the invention includes a further 30 advantageous apparatus on a cleaner, a carding machine or the like for cleaning and opening textile fibre material, especially cotton, in which downstream of a feed device there is arranged a rotating clothed or needle roller that is surrounded by a casing that has at least one opening for

removal of impurities such as trash particles, bits of leaf, seed husks, bits of stalk, sand and the like, in which associated with the clothing or the needles of the clothed or needle roller is at least one separating blade
5 with a blade edge, which is directed against the direction of rotation of the clothed or needle roller and is arranged at the opening, in which the separating blade consists of a plurality of blade elements and the spacing between the individual blade elements and the clothing or the needles
10 of the clothed or spiked roller can be changed.

The fact that the separating blade consists of a plurality of blade elements, the spacing of which with respect to the roller can be individually adjusted or changed, enables the separation to be individually adapted
15 to locally different contents or local concentrations, optionally down to individual foreign bodies, in a simple manner. Defined separation takes place. Advantageously, this includes both a selective short-time separation (a foreign constituent is detected and individually
20 separated), and the different setting of the individual blade elements across the width of the machine for a longer term, in order, for example, to counteract detected accumulations of foreign constituents across the width of the machine.

25 Advantageously, the different spacing is continuously adjustable. Preferably, the magnitude of the different spacing is adjustable in dependence on the concentration, for example, the amount, accumulation and the like of the impurities. Advantageously, the spacing of a blade element
30 can be changed for a short time. Preferably, the spacing of at least two blade elements can be changed for a short time. Preferably, the instant for change is controllable by a measuring device for the impurities. Advantageously, selection of the corresponding blade element or the

corresponding blade elements is controllable by the measuring device for the impurities. Advantageously, each blade element is individually fixed to a common retaining element. Preferably, the separating blade is in the form
5 of a comb or the like, having a plurality of blade elements. Preferably, the blade elements consist of a resilient material, for example, steel or the like. Preferably, there is a space between adjacent blade elements. Advantageously, an adjusting device is
10 associated with each blade element. Advantageously, the adjusting device comprises electromagnetic elements. Advantageously, a common suction device for the impurities and the like is associated with the separating elements. Advantageously, at least one curved covering surface is
15 present around the clothed roller or needle. Advantageously, a plurality of guide elements for the fibre material is arranged upstream of the separating blade and the spacing between the individual guide elements and the clothed roller or needle roller can be changed.
20 Advantageously, the guide body is of comb-like construction. Advantageously the guide body comprises a common retaining region and a plurality of guide elements mounted thereon and open at one end.

Certain illustrative embodiments of the invention will
25 be explained in detail below with reference to exemplary embodiments illustrated in the drawings, in which:

Fig. 1 is a schematic in side view of a carding machine with a supporting and guiding member for
30 the fibrous web, showing three possible locations of the apparatus according to the invention;

Fig. 2 is a side view of a first construction of apparatus according to the invention between the

stripping roller and squeezing rollers of a carding machine;

5 Fig. 3 is a perspective view of the apparatus according to the invention with two cameras;

Fig. 4 is a section through a guide element with a piezoelectric flexing transducer;

10 Fig. 5 is a plan view of fibre material being processed, showing a foreign body, the detector region, the guide elements and the separating blade; and

15 Fig. 6 shows a further embodiment comprising segmented, individually displaceable separating blades.

Figure 1 shows a carding machine, for example, a high-performance DK 903 (trade mark) carding machine made by Trützschler & Co KG, with feed roller 1, feed table 2, licker-ins 3a, 3b, 3c, cylinder 4, doffer 5, stripping roller 6, squeezing rollers 7, 8, web-guide element 9, web funnel 10, take-off rollers 11, 12, revolving card top 13 with card top bars 14, can 15 and can coiler 16. The directions of rotation of the rollers are shown by respective curved arrows. The letter A denotes the working direction. A supporting and guiding member 17 for the fibrous web 18 is arranged beneath the stripping roller 6. The letter B denotes the region in which the detached fibrous web passes from the supporting and guiding member 17 to the roller nip between the squeezing rollers 7, 8. A first construction of the invention (see Figs 2 to 4) is arranged in the region B. A further construction of the

invention (see Fig. 6) can be arranged in the regions C and D associated with the cylinder 4.

A first embodiment of the invention is illustrated in Fig. 2. The supporting and guiding member 17 has essentially a four-cornered cross-section. The upper surface is slightly concavely curved. The radius of curvature of the curve of the surface is greater than the radius of curvature of the stripping roller 6. The arrow A indicates the running direction of the fibrous web 18. The front end region has an edge, the rear end region is rounded. The edge prevents impurities, for example honeydew, from being deposited. The sliding contact region of the surface is cleaned, for example, of trash, by the web 18 sliding thereover. The cross-sectional shape of the element 17 is adapted to the air flow conditions in the region between the doffer 5, the stripping roller 6 and the squeezing rollers 7, 8. The element 17 serves as a supporting and guiding element for the fibrous web 18. The element 17 is in the form of a housing, a transparent window 19 being provided in the contact region. The fibrous web is located initially on the clothing of the doffer 5, is guided in the roller nip between doffer 5 and stripping roller 6 around and over the clothing of the stripping roller 6, is detached from the stripping roller 6 a little way after the region of the perpendicular diameter, is guided in the sliding contact region on the surface in direction A, following the end region runs through the region B and finally enters the roller nip between the squeezing rollers and passes between these. A camera 20, for example, a diode line camera, and an illuminating device, for example, comprising several light-emitting diodes, are arranged in the interior 17a of the housing 17. Between the element 17 and the roller nip between the squeezing rollers 7, 9 a first construction of

the apparatus according of the invention is arranged in the region B. The fibrous web 18 runs over a supporting element 21, downstream of which are arranged a separating blade 22 with a separation opening 23 and a suction hood

5 24. Above the fibre material 18 there is a guide element 25 consisting of a plurality of guide elements 25a to 25n (see Fig. 3), which, when not activated, are merely in light sliding contact or not in contact at all with the fibre material 18.

10 Fig. 3 shows the supporting element 21, arranged over the width of which are two cameras 20a, 20b, which are connected to an image-evaluating device (not illustrated) and to an electronic control and regulating system (not illustrated), both of which can constructed, for example,

15 as described in German Patent Application 196 04 499.5. The supporting element 21, for example, a metal plate, has beneath the guide elements an indentation 21a, which forms a constriction. A further guide plate 27 is arranged downstream of the separating blade 22. The guide element

20 25 is approximately of comb-like construction, a common retaining plate 25' forming one end of the guide elements 25a to 25n, the other ends the guide elements 25a to 25n being separated from one another by gaps. The retaining region 25' is rigidly fixed to two supports 26a, 26b (only 25 26a is shown), for example, by means of screws 32. The guide elements 25a to 25n are resilient and on being activated and deactivated are displaced in the direction of arrows E and F.

Referring to Fig. 4, the guide element 25a mounted at 30 the retaining region 25' is in the form of a piezoceramic bending transducer. There is a central carrier material 25₁, to each of the two sides of which there is applied a respective piezoceramic layer 25₂, 25₃. On the outside of the piezoceramic layers 25₂, 25₃ there is a respective

contacting and protective layer 25₄, 25₅. The reference numbers 29, 30 denote a mechanical displacement limiting means.

As shown schematically in Fig. 5, in operation a foreign body 28 located in region a in the fibre material 18, which is moving beneath the cameras 20a, 20b in direction A, is detected, whereupon an electrical pulse is generated by way of the control and regulating system; the electrical pulse causes the guide element 25f located in region a to be displaced downwards in the direction of arrow E (Fig. 3) on account of the piezoelectric effect. The guide element 25f consequently presses only the fibre material region a containing the foreign body 28 downwards, so that the spacing with respect to the blade edge of the separating blade 22 is reduced, that is, separation of the foreign body 28 is facilitated. In this way, selective separation of foreign bodies 28 is improved. The reference number 31 denotes the detection range of the cameras 20a, 20b.

Opening and scutching machines, carding machines and combing machines have, *inter alia*, the task of removing foreign constituents from the processed material. In the case of cotton, these foreign constituents are neps, seed fragments (including accumulations of husk) and trash particles of different size. Separation is based on the physical differences between these foreign constituents and the fibre material; generally, these are differences in density, differences in the mass-surface ratio (slenderness ratio, flow resistance) and differences in the bond to the fibrous web. Utilising these differences, the material is subjected to accelerations and/or air currents, the magnitude and orientation of which are such that preferably the foreign constituents are separated. The process of separation is therefore not specific: the entire flow of

material is subjected to the separation process; by virtue of the above-mentioned physical differences, an accumulation of foreign constituents occurs in the statistical mean.

5 Important to the invention as implemented in, for example, Fig. 3 is the combination of a detection unit (cameras 20a, 20b) scanning the entire width of the machine and including hardware and software that generates control signals for an actuator-movable guide element from the
10 result of the detection, an actuator-movable guide element 25 controllable individually across the width of the machine, and a continuously-acting separation element (blade 22). At the level of the detection line 31, the entire mass flow of fibre 18 running past is scanned and
15 checked for foreign constituents 28. This can be effected using the image-processing method (several cameras and evaluation units analogously to those in the Trützschler-NCT {trade mark} system), or alternatively by other methods. On the basis of a predeterminable threshold, an
20 evaluating logic decides which of the detected foreign constituents 28 are to be separated. Here, in addition to the desire for as few foreign constituents 28 as possible in the end product, it must be taken into account that each separation initiated represents a reduction in the amount
25 of fibre previously scanned, and hence adversely affects the subsequent sliver uniformity (CV value). The detection device 20 is followed by the guide element 25, which deflects the mass flow of fibre 18 in a very small region a of the machine width or fibre material width b
30 away from the pre-set direction of movement. Underlying this arrangement is the concept of separating the individual manipulation of the foreign constituent 28 and the actual separation process from one another. It is important to deflect the fibrous web 18 on the basis of the

above-described detection at the correct point partially into the operating range of a continuously- acting separating device 22. The forces required for that purpose are small, so that, for example, advantageously
5 piezoceramic bending transducers can be used. Other fast-
acting actuators, for example, electromagnetic transducers,
pneumatic cylinders or similar can also be used. The end
of the arrangement is formed by the separating line, which
can be formed, for example, by a suction hood 24 with
10 separating blade 22 or a high-speed separating roller.

In a further embodiment illustrated in Fig. 6,
separation is effected at a roller, for example, a carding
cylinder. The separating blade 22 consists of a plurality
15 of blade elements 22a to 22n across the width. The blade
elements can be individually activated and displaced in the
direction of arrows G, H. In this case, compared with the
construction illustrated in Fig. 2, the (segmented)
separating blade of the suction hood replaces the
15 (segmented) guide element 25. Separation of a foreign
body 28 in the fibre material is initiated by local
approach of a blade element, for example, 22c, for example,
20 towards the clothing 4a of the rotating cylinder 4 in
direction G.

In addition to selective short-time separation (a
25 foreign constituent 28 is detected and individually
separated), the individual blade segments can also be
differently adjusted for the longer term over the IFW
(inside frame width) on the basis of a scanning with the
image-processing, for example, NCT system, in order, for
30 example, to counteract detected accumulations of foreign
constituents 28 across the IFW.

Claims

1. An apparatus on a textile fibre processing machine or the like for detecting unwanted particles in textile fibre material and removing them therefrom, in which across the width there is provided a detector device and downstream thereof a separating device for removing the particles, wherein between the detector device and the separating device a plurality of guide elements are provided across the width, which are able selectively to deflect the regions of the fibre material containing the unwanted particles.
2. An apparatus according to claim 1, in which the detector device comprises at least one camera.
3. An apparatus according to claim 1 or claim 2, in which the detector device comprises an electronic evaluating device for detection of the particles.
4. An apparatus according to any one of claims 1 to 3, in which the detector device is capable of supplying control signals for at least one movable guide element.
5. An apparatus according to any one of claims 1 to 4, in which the movable guide elements are individually controllable.
6. An apparatus according to any one of claims 1 to 5, in which the actuator-movable guide elements are present.
7. An apparatus according to any one of claims 1 to 6, in which the instant for deflection is controllable by the detector device.
8. An apparatus according to any one of claims 1 to 7, in which selection of the corresponding guide element or the corresponding guide elements for deflection is controllable by the detector device.

9. An apparatus according to any one of claims 1 to 8, in which a controllable adjusting device is associated with each guide element.
10. An apparatus according to claim 9, in which each 5 adjusting device comprises an inductive element.
11. An apparatus according to claim 9, in which each adjusting device comprises a pneumatic element.
12. An apparatus according to claim 9, in which each adjusting device comprises a piezoelectric element.
- 10 13. An apparatus according to claim 12, in which the guide element comprises a piezoceramic bending transducer.
14. An apparatus according to any one of claims 1 to 13, in which the detector device can scan the fibre material across the width for impurities and the like.
- 15 15. An apparatus according to any one of claims 1 to 14, in which the detector device comprises an optical measuring device.
16. An apparatus according to claim 15, in which the optical measuring device is a camera.
- 20 17. An apparatus according to claim 15 or claim 16, in which the measuring device is connected to an electronic image-processing device.
18. An apparatus according to claim 17, in which the electronic image-processing device comprises a control 25 device, for example, a computer.
19. An apparatus according to any one of claims 1 to 18, in which actuators for adjusting the guide elements are present.
20. An apparatus according to any one of claims 1 to 19, 30 in which the displacement can be effected substantially in a direction perpendicular to the working direction.
21. An apparatus according to any one of claims 1 to 120, in which the displacement of at least one guide element can

selectively change the spacing between the fibre material and the separating device.

22. An apparatus according to claim 21, in which the spacing can be reduced on displacement of at least one

5 guide element.

23. An apparatus according to any one of claims 1 to 22, in which the arrangement is such that in use the fibre material runs between the guide elements and an opposite surface.

10 24. An apparatus according to claim 23, in which the arrangement is such that in use the fibre material is in contact with the opposite surface.

25. An apparatus according to claim 23, in which the arrangement is such that in use the fibre material is in 15 contact with the guide elements at least during deflection.

26. An apparatus on a carding machine, a cleaner or the like for detecting unwanted particles, especially trash particles, husk accumulations, bits of seed and the like in textile fibre material and removing them therefrom, in 20 which across the width there are provided at least one detector device, for example, a camera, having an electronic evaluating device for detection of the particles, and downstream thereof a separating device for removing the particles, characterised in that between the 25 detector device, for example, a camera, and the separating device a plurality of guide elements are provided across the width, which are able selectively to deflect the regions of the fibre material containing the unwanted particles.

30 27. An apparatus on a textile fibre processing machine, in which downstream of a feed device there is arranged a rotating clothed or needle roller that is surrounded by a casing with at least one opening for removal of impurities, in which associated with the clothing or the needles of the

clothed or needle roller is at least one separating blade comprising a blade edge that is directed against the direction of rotation of the clothed or needle roller and is arranged at the opening, wherein the separating blade 5 comprises a plurality of blade elements and the spacing between the individual blade elements and the clothing or the needles of the clothed roller or needle roller can be changed.

28. An apparatus according to claim 27, which is

10 furthermore in accordance with any one of claims 1 to 26.

29. An apparatus according to claim 27 or claim 28, in which the different spacing is continuously adjustable.

30. An apparatus according to any one of claims 27 to 29, in which the magnitude of the different spacing is

15 adjustable in dependence on the concentration of the impurities.

31. An apparatus according to claim 30, in which the magnitude of the spacing is adjustable in dependence on the amount or distribution of the impurities.

20 32. An apparatus according to any one of claims 27 to 31, in which the spacing of a blade element can be changed for a short time.

33. An apparatus according to any one of claims 27 to 32, in which the spacing of at least two blade elements can be

25 adjusted.

34. An apparatus according to any one of claims 27 to 33, in which the instant for change is controllable by a measuring device.

35. An apparatus according to any one of claims 27 to 34, 30 in which selection of the corresponding blade element or the corresponding blade elements is controllable by the measuring device for the impurities.

36. An apparatus according to any one of claims 27 to 35, in which each blade element is individually fixed to a common retaining element.
37. An apparatus according to any one of claims 27 to 36, 5 in which the separating blade is in the form of a comb or the like, having a plurality of blade elements.
38. An apparatus according to any one of claims 27 to 27, in which the blade elements are of a resilient material.
39. An apparatus according to claim 38, in which the blade 10 elements are of steel.
40. An apparatus according to any one of claims 27 to 40, in which there is a space between adjacent blade elements.
41. An apparatus according to any one of claims 27 to 40, in which an adjusting device is associated with each blade 15 element.
42. An apparatus according to claim 41, in which the adjusting device comprises electromagnetic elements.
43. An apparatus according to any one of claims 27 to 42, in which at least one curved covering surface is present 20 around the clothed roller or needle roller.
44. An apparatus according to any one of claims 27 to 43, in which a guide body having a plurality of guide elements for the fibre material is arranged upstream of the separating blade and the spacing between the individual 25 guide elements and the clothed roller or needle roller can be changed.
45. An apparatus according to claim 44, in which the guide body is of comb-like construction.
46. An apparatus according to claim 44 or claim 45, in 30 which the guide body comprises a common retaining region and a plurality of guide elements mounted thereon and open at one end.

47. An apparatus according to any one of claims 1 to 46, in which a common suction device for the impurities and the like is associated with the separating.

48. An apparatus on a cleaner, a carding machine or the like for cleaning and opening textile fibre material, especially cotton, in which downstream of a feed device there is arranged a rotating clothed or spiked roller that is surrounded by a casing with at least one opening for removal of impurities, such as trash particles, bits of leaf, seed husks, bits of stalk, sand and the like, in which associated with the clothing or the spikes of the clothed or spiked roller is at least one separating blade comprising a blade edge that is directed against the direction of rotation of the clothed or spiked roller and is arranged at the opening, especially according to any one of claims 1 to 22, characterised in that separating blade consists of a plurality of blade elements and the spacing between the individual blade elements and the clothing or the spikes of the clothed roller or spiked roller can be changed.

49. An apparatus on a textile machine substantially as described herein with reference to and as illustrated by any of Figs. 1 to 6.

50. A method of removing impurities from fibre material, comprising advancing the fibre material past a detector device which is able to identify the location of the impurities, causing a portion of the fibre material to be deflected relative to a portion adjacent thereto in a transverse direction relative to the direction of movement of the fibre material, and separating the deflected portion including the impurities.



INVESTOR IN PEOPLE

Application No: GB 0215564.6
Claims searched: 1-26,47(part)

Examiner: Alex Littlejohn
Date of search: 12 November 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed. T): D1N

Int Cl (Ed.7): D01G

Other: Online: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2340137 A (Trutzschler) see independently movable trays 7	-
X	EP 0967305 A (Jossi) see whole document, especially col 2 lines 29,30	1,26 at least
X	DE 4340173 A (Hergeth) see whole document, especially means 11,13	1,26 at least
X	US 4909930 A (Cole) see whole document, especially means 12,14	1,26 at least

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